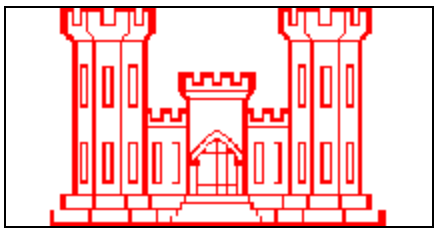

US Army Corps of Engineers
North Atlantic Division

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Annual Water Quality Management Report

January 2000

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NORTH ATLANTIC DIVISION
WATER QUALITY MANAGEMENT REPORT
(1999)

ABSTRACT

This water quality management report is prepared in accordance with the requirements of CECW-EH-W memo dated 3 November 1998. The report summarizes the activities of the North Atlantic Division's overall Water Quality Management Program. In general, Division water quality management goals are for projects to be in compliance with Federal and State Water Quality Standards and attainment of project purposes. Water quality enhancement has been attained for all projects in the NAD area.

Items included in this report are technical capabilities and responsibilities in the division and district offices, relationships between water quality and water control management activities, contracted workload, laboratory facilities, data management systems, training, coordination with other agencies, research and development needs, and special studies completed or required.

1. **Technical Capabilities and Staff**

A) NAD Office

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B) Philadelphia District.

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C) Baltimore District.

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D) Norfolk District

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E) New York District

Operations Division--CENANOP-SD

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Mike Harris	CENANOP-SD	Oceanographer	(212)264-1585
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F) New England District

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2. Relationship Between Water Quality and Water Control Management Activities

A) Philadelphia District.

Stratification monitoring was performed at four of five District Reservoirs - Blue Marsh, Beltzville, Prompton, and F.E. Walter to identify and monitor various water quality conditions within each reservoir. Additional stratification monitoring at Blue Marsh and Beltzville Reservoirs was performed to determine selective withdrawals for maintenance of downstream water temperatures. The Water Quality Contractor provides stratification reports directly to the Districts Hydrology and Hydraulics Branch. The relationships between water quality and water control management activities are periodically reviewed when a water quality or water control management concern arises.

B) Baltimore District

Water Control and Water Quality Management are both responsibilities of the Water Control & Quality Section, Geotechnical & Water Resources Branch, Engineering Division.

C) Norfolk District.

The Hydraulics and Hydrology Section of the Engineering, Construction and Operations Division, has overall responsibility for District Water Control Management and Water Quality Activities at the Gathright Dam and Lake Moomaw Project.

D) New York District.

NYD manages and studies water quality concerns which are primarily related to dredging and dredged material disposal operations associated with civil works projects, and secondarily related to various associated studies.

E) New England District.

New England District has no reservoirs with selective withdrawal capabilities. Water quality coordination for the operation of NAE's reservoir projects was required only for special operations such as low flow augmentation storage at Thomaston Dam in 1999.

3. Contracted Workload

A) NAD Office.

The Division office has had no contracted workload in the past and there is none planned in the immediate future.

B) Philadelphia District.

All water quality monitoring, other than stratification monitoring was performed through contract with VERSAR, Inc. of Columbia, Maryland.

C) Baltimore District.

Phytoplankton and zooplankton samples were collected from selected District reservoir projects to assist in evaluating their productivity, aquatic food-chain dynamics, and overall water quality. The samples were sent to Aquatic Analysts in Wilsonville, Oregon for identification, enumeration, calculation of biologic indices, and interpretation of the results.

D) Norfolk District.

For 1999, the District contracted with one commercial laboratory for the analysis of water samples obtained from the Gathright Dam and Lake Moomaw project by project personnel. The contract provides for the analysis of nutrients, iron and manganese, and bacteriological parameters.

E) New York District.

Bioassay/bioaccumulation testing along with other biological and chemical analyses are contracted out to commercial testing laboratories. Feasibility studies for alternatives to ocean disposal and for monitoring of the Mud Dump have been contracted to private contractors and universities, USACOE Waterways Experiment Station (CEWES), and other Federal Agencies. Most contracts, IAO's, and Interagency Agreements are managed by CENANOP-SD staff.

E) New England District

All analytical work for the water quality program is contracted out to various companies including Alpha Analytical, Microbac, Biological Services, Eastern Analytical, Aquacheck Water Testing, and Northeast Labs. An angler survey begun in FY98 with water quality program funds, was contracted to WES using project funds in FY99.

4. Laboratory Facilities

A) NAD Office. None

B) Philadelphia District.

All Laboratory work for reservoir water quality was conducted at two facilities. Blue Marsh Laboratory of Douglassville, Pennsylvania performed analysis of drinking water samples and bacteria. Kemron Environmental Services of Marietta, Ohio performed the remaining analyses.

C) Baltimore District.

A laboratory facility is located in the Water Control & Quality Section at the City Crescent Building in Baltimore.

D) Norfolk District.

The Norfolk District has no laboratory facilities. For 1999, OLVER, INC., under contract with the Norfolk District, performed water quality analyses on samples from the Gathright Project.

Personnel from the Corps of Engineers, South Atlantic Division Laboratory inspected OLVER Inc. in January 1997 and concluded that the laboratory has the capabilities to satisfactorily perform the contracted tests and measurements.

E) New York District.

CENANOP-SD maintains a sampling and storage facility at Caven Point, New Jersey which is primarily used for preparation, limited testing and storage of dredged material and water samples. The facility contains state-of-the art equipment for sediment grain size analysis and refrigerated storage for sediment samples, including cores. Marine borer test boards, used in harbor-wide monitoring, are also prepared at this facility

F) New England District

All environment work for water quality was performed by our Environmental Laboratory, including collecting samples, and either performing or contracting analysis.

5. Data Management Systems.

A) Philadephia District

VERSAR, Inc. submits annual individual reservoir water quality and database trend analysis reports to CENAP-PL-E. The Contractor directly inputs individual reservoir data into the respective reservoir databases

B) Baltimore District.

The Water Control Data System (WCDS) is implemented on the Baltimore District LAN and presently includes the following networked equipment: four UNIX workstations (two SUN SPARCSTATION 20's and two SUN SPARC ULTRA 1's), two Compac 486 PC database servers, and eight X-terminals. Other networked equipment include an Integral Systems DOMSAT Receive Station, a HP Laser Jet 5M printer, a HP Paint Jet XL300 color printer and a HP Scan Jet IIc desktop scanner. A Compac Armada 4110 and a Compac Elite laptop PC are used for remote access to the WCDS. Real-time Doppler weather radar images are obtained via DTN Weather.

Significant FY 99 activities regarding the WCDS are as follows:

a. Improvements for displaying water control data and information continued as web server capabilities were expanded.

b. The SUN SPARC ULTRA 1's were upgraded with additional memory and hard disk storage to accommodate the WCDS modernization efforts.

c. WCQS staff began the process for replacing the section's eight X-terminals with high-end PC's running X-Windows emulation (EXCEED). This will eliminate the need for water control managers to have both a PC and an X-terminal.

d. The WCDS Continuity of Operations Plan (COOP) with CENAP was successfully utilized for several days in June 1999 while the DOMSAT Receive Station (DRS) was being upgraded to ensure Y2K compatibility. In July, the COOP was upgraded to the NAP62 SUN SPARC ULTRA 1 workstation and successfully tested.

e. Software was upgraded and systems tested, as necessary, to address known Y2K compliance issues.

f. During FY 99, WCQS staff actively participated in the ongoing WCDS modernization efforts. Baltimore District was chosen as one of four initial deployment sites for the modernized WCDS software. Efforts included: participation in weekly conference calls with OCE, HEC, and personnel from the other WCDS deployment sites, and continued participation on the Corps Users Review Group (CURG) and on the System Design and Test (SDT) team developing a model for flood impact assessment.

In preparation for the initial WCDS deployment, WCQS staff developed a series of models for the North Branch Potomac River above Cumberland, MD. This included a HMS model which was converted from an existing HEC-1 model, a HEC-RSS reservoir simulation model that utilized the limited capabilities of the newly developed RSS program, a HEC-RAS model that

was, for the most part, assembled from existing HEC-2 models done for FEMA Flood Insurance Studies, and an HEC-FIA model adapted from an existing HEC-PBA model.

In March, HEC staff visited Baltimore District to install the initial deployment version of the modernized WCDS software and get it up and running. This included the installation of the Oracle database software on our system, bulkloading of historical data from HEC-DSS files, and establishing real-time data acquisition streams for DCP data and SHEF encoded data. The models were linked so that execution would automatically progress from HMS to FIA.

Subsequent months were devoted to evaluation and testing of the system with frequent consultation with and feedback to the developers at HEC.

g. GIS software packages, ArcView and ArcInfo, were utilized to develop hydraulic and hydrologic models for use with the modernized WCDS. Specifically, the GIS software was utilized to compute hydraulic routing parameters, delineate sub-basins, and develop rainfall distribution grid cells for the North Branch Potomac River basin. In addition, CorpsView (an ArcView application developed by CRREL for water control use) was used to view DSPLAY plots and to plot and view flood inundation areas.

C) Norfolk District.

All data is obtained, analyzed, reduced, and stored in digital format. The lake monitoring data is collected with a Hydrolab 5200A unit and stored on District personnel computers.

D) New York District.

Sediment testing results for all analyzed projects are input into a network Oracle database. CENANOP-SD also maintains an up-to-date computerized summary of dredging and ocean disposal activities (federal channel and private applicant volumes dumped at the Mud Dump Site and HARS, dates of disposal, current permits). The GIS database is potentially useful for designating new or replacement ocean disposal sites and Borrow Pits, and as a support tool for the New York Bight Monitoring and Modeling study. Software for evaluating bioassay, bioaccumulation and barge overflow data have been developed for CENANOP-SD and are being honed for use in all data compilation and review.

E) New England District.

Data had been stored on the Laboratory Information Management System (LIMS), and transferred to users in PC-compatible spreadsheets. In FY99 NAE purchased GIS\Key software for storing, retrieving, and analyzing water quality (and HTW) data. Use of GIS\Key will begin in early FY00.

6. Training

A) NAD Office.

CENAD personnel were not involved any water quality training in 1999.

B) Philadelphia District.

No official training was attended this year. However, numerous conferences and meetings were attended that provided training in an informal setting and were directly related to operations of District Reservoirs. These include:
The Annual Pennsylvania Lake Management Society Conference
The Lehigh River Watershed Conference
The Blue Marsh Reservoir Water Quality Meeting
The Beltzville Reservoir Water Quality Meeting
The Mid-Atlantic Water Pollution Biology Workshop
The Blue Marsh Lake Symposium--Research and Implementation of Water Quality Improvements.

C) Baltimore District.

The following are training courses taken by CENAB Water Control staff - FY99.

COURSE TITLE	NUMBER ATTENDING
1. HEC-HMS	2
2. HEC-RAS	1
3. Introduction to Oracle: SQL and PL/SQL	2
4. HQ/UOC Emergency H&H Support Workshop	2
5. Ocean Engineering Mechanics	1
6. Open-Channel Hydraulics	1
7. Geotechnical Marine Engineering	1
8. Mid-Atlantic Water Pollution Biology Workshop	1
9. Covey – 7 Habits of Highly Effective People	2

D) Norfolk District.

No CENAO personnel were involved in water quality training during 1999.

E) New York District.

No CENAN personnel were involved in water quality training during 1999.

F) New England District.

In June, a contractor from GIS Solutions came to NAE to give a short course on storing water quality data in GIS\Key. There was no other formal water quality-related training in FY99.

7. Interagency Coordination.

A) Philadelphia District.

Data on file with the District is made available to all that make the request. CENAP-PL-E regularly sends annual reservoir water quality monitoring data to the Pennsylvania Fish and Boat Commission, Western Berks Water Authority and Pennsylvania Department of Environmental Protection (PADEP). Results of the drinking water analyses are sent on a quarterly basis to the PADEP. Zebra mussel monitoring data sheets are sent on an annual basis to PADEP. Additional copies of the Blue Marsh Reservoir Annual Water Quality Monitoring Report are sent to DRBC and Albright College. Additional copies of the Beltzville Reservoir Annual Water Quality Monitoring Report are sent to DRBC, the Wildlands Conservancy in Emmaus, Pennsylvania, and the Lehigh River Watch/Parkland High School in Orefield, Pennsylvania.

The Philadelphia District presented all aspects of its water quality monitoring program and results to Federal, State, and local governments and private entities at the following conferences:

a. The Blue Marsh Lake Water Quality Meeting.
b. The Beltzville Reservoir Water Quality Meeting.
c. The Blue Marsh Lake Symposium-Research and Implementation of Water Quality Implrovements.

B) Baltimore District.

The Baltimore District maintains contact with the Maryland Department of Natural Resources to keep them aware of water control operations and its water quality impacts on fisheries at Jennings Randolph and Savage Lakes when the operation causes significant change of water quality conditions in the lake and downstream. This reduces conflicts with agencies.

The Baltimore District also maintains contact with the Pennsylvania Department of Environmental Protection and Susquehanna River Basin Commission providing them with an awareness of water quality operations that may impact on water quality in Corps lakes or downstream of the project. These notifications are made for any operation that deviates from the approved regulation plan and includes gate shutdowns for conduit inspections and lake drawdowns for maintenance.

Water Control & Quality Section also coordinates water quality activities with other agencies including the Maryland Department of Freshwater Fisheries, Susquehanna River Basin Zebra

Mussel Monitoring Network, Pennsylvania Fish & Boat Commission, Chesapeake Watermans Association, Mineral County Parks & Recreation Commission.

C) Norfolk District.

Water quality efforts are coordinated with the state of Virginia, National Weather Service, U.S. Geological Survey, U.S. Forest Service, U.S. Fish and Wildlife, and EPA Region III.

D) New York District.

CENANOP-SD coordinates regularly with other state and federal regulatory and Scientific/technical agencies through regular meetings, letters and phone conversations. In addition, many concerns and questions are verbalized at Harbor Estuary Program (HEP) meetings where various tiers of involvement cover technical, management and policy information and eventual decisions.

Presently, different public involvement groups are a part of various workgroups.

E) New England District.

Data on file with the District is made available to all who request it. Results of drinking water analyses are sent to the appropriate State agency within 24 hours. Beach analyses at New Hampshire projects are sent to the New Hampshire Department of Environmental Services monthly. Water quality monitor data from the Town Brook tunnel is sent to Massachusetts monthly. NAE produces an Annual Water Quality Report in its own format, and copies are sent to State agencies in all 6 New England States, the U.S. EPA, and interested private organizations.

8. Research and Development Needs.

A) New York District

1. Capping effectiveness
   a. Problem: Define the effectiveness of capping procedures at isolating contaminated sediments.
   b. Product Desired: Information and data on effects of layering caps; long term integrity of caps; effectiveness of different types of caps; suitability of final cap material.
   c. Assessment: Will affect material which requires capping in a confined disposal facility or which may be eligible in the future for capping at an ocean disposal site; also helpful in assessing certain impacts of placing a remediation "cap" at the HARS.

2. Dioxin Effects
   a. Problem: Redefine understanding of dioxin effects and how to mitigate for its disposal.

b. Product desired: Establishment of realistic evaluative framework and scientifically based criteria for TCDD and other isomers; applicable decontamination technologies; effects of trophic transfer.
c. Assessment: Affects large volume of material proposed for dredging and disposal; will have huge impact on all dredging in harbor; costs: $400,000 to 1.5 million.
d. POC: Monte Greges, CENANOP-SD; 264-5620

3. Bioaccumulation

a. Problem: Establish appropriate bioaccumulation criteria for use in the District's ocean disposal testing program.
b. Desired: Need valid lists of scientifically based criteria for all contaminants evaluated in our dredged material management program.

B) Philadelphia District

1. Problem - Bacteriological Contamination at the Reservoirs.

a. Product Desired - A detailed evaluation of water quality data taken at the reservoirs throughout thyears in combination with an investigation into their current and past land uses is desired to assess contamination trends and locate point and non-point sources of pollution.

b. Assessment of Problem - Fecal coliform levels have periodically exceeded the limit throughout the years at the reservoir sites. A database was developed in 1996 using all historical reservoir data currently available. Fecal coliform data trends were also developed for the reservoirs.

2 . Problem – Lehigh River water quality

a. Product Desired – A watershed model to evaluate the water quality of the Lehigh River and the affect the F.E.Walter and Beltzville reservoir operations have on it.

b. Assessment of Problem - Currently a cooperative effort amongst Federal, State, and private entities is in place to define water quality conditions in the Lehigh River.

3. Problem – Nutrient loading and algal biomass at Blue Marsh Reservoir

a. Product Desired – An accurate assessment of individual sub-watershed loadings entering the reservoir so restoration efforts can focus on those watersheds with the highest nutrient loads.

b. Assessment of Problem – Nutrient loading from the Blue Marsh Reservoir watershed

C) Baltimore District

Remedy gas supersaturation in stilling basin of Jennings Randolph Lake.

a. Problem - Gas supersaturation occurs when large releases are made, resulting in injuries or death to some fish species.

b. Product Desired - Recommendation for an economical solution.

c. Assessment of Problem - Problem occurs about 15-30 days per year. Cost of problem is unknown.

D) New England District

1. Problem - Bacterial Contamination of Beaches after Rainstorms

a. Product Desired - Means to determine when to close and reopen beaches after rainstorms without having to wait one to two days for sampling results..

b. Assessment of Problem - High bacteria counts occur at beaches most often after it rains, but it takes one to two days to get sampling results; this delay can be even longer on weekends when demand for access to the beaches is highest. The result can be that beaches are open when they shouldn't be and closed unnecessarily. An administrative closure protocol based on past experience is needed. NAE has been experimenting with closure protocols based on the past rainfall and bacteria records at the beach.

2. Problem - Difficulties Encountered Using the LFATE Computer Model.

a. Product Desired - The "user friendly" version was found to have relatively few options for handling output. Changes to allow control of printout and manipulation of files would be extremely useful.

b. Assessment of Problem - The LTFATE model developed by WES to determine the long term fate of contaminants in dredged material is an example of an important program that needs improvement. NAE is using it in the Providence River Study to help determine whether open water disposal sites can continue to be used.

E) Norfolk District

Problem - 1. Releases must be made from lower port elevations in order to maintain cold-water discharge temperature objectives. During summer stratification, manganese concentrations are elevated in the hypolimnion and therefore lead to elevated manganese releases.
Problem - 2. Metalimnetic Oxygen minima occuring within the reservoir. This problem frequently appears when releasing cooler water from lower port elevations.

a. Product(s) Desired - A widely applicable, user-friendly computer-based optimization scheme that integrates the combination of chemical, biological and physical (thermal) properties which can be used to minimize the negative impacts on reservoir water quality and tailwater quality.

b. Assessment of the problem - These problems usually occur annually in the late summer and can adversely impact both reservoir and downstream fisheries. No costs were developed since this scheme would be widely applicable for any project with multi-level intake towers.

9. Special Studies.

A) Philadelphia District.

a. Priority Pollutant Testing - In accordance with the CECW-W letter dated 3 June 1983, subject: Reservoir Contamination of Corps Reservoirs, and the NADEN-TH letter dated 16 July 1984, subject: Reservoir Contaminants, CENAP initiated in 1984 a priority pollutant testing program to augment the normal water quality monitoring activities. The 1984 field sampling effort included all priority pollutants listed in the U.S. Environmental Protection Agency's Quality Criteria for Water (Red Book) and its amendments. In 1985, CENAP divided the priority pollutants into 3 groups - Group 1: Volatile Organics, PCBs, and Pesticides; Group 2: Metals and Acid Extractables; and Group 3: Base Neutrals, so that each group would be sampled alternately each year. Group 3 was sampled for and analyzed in July 1999.

b. Benthic Macroinvertebrate Assessments - A monitoring program to assess the benthic macroinvertebrate communities of streams flowing into and out of the reservoirs would help in establishing and comparing the ecological integrity of those surface flows. This data can be used to provide an ecological measure of fluctuating environmental conditions because communities integrate stresses over time. Because these biological communities reflect the overall ecological integrity of a system, the biosurvey results would directly assess the waterbodies status relative to the Clean Water Act. In addition, this data can help identify pollutant sources entering the reservoir.

The Pennsylvania Fish and Boat Commission, in cooperation with the Philadelphia District, has established a benthic macroinvertebrate sampling regime to monitor water releases from the District's F.E. Walter Reservoir in 1998 and 1999. Results of the data analysis will help determine the ecological impact water releases have on downstream communities. The Pennsylvania Fish and Boat Commission is currently analyzing the data.

B) Baltimore District

1) Evaluations of operating procedures continue at Jennings Randolph and Savage (North Branch Potomac River) and the Tioga-Hammond Lakes projects.

2) Continue to monitor gas supersaturation problem at the Jennings Randolph Lake project.

3) Continue to monitor Dust Alleviation Program at Foster J. Sayers Lake.

C) Norfolk District.

The District again prepared in the Spring of 1999 to identify a greenish-yellow organism that had appeared on the reservoir in the springs of 1984 and 1985 after the ice cover melted. However, once again in 1998, the reservoir neither froze nor was the aforementioned organism observed. The District is again prepared to attempt to identify this organism if it appears in the Spring of 2000.

D) New York District

CENAN was not involved in any special studies in 1999.

E) New England District.

Studies that are part of the reservoir water quality management program.

a. French and Blackstone River Priority Pollutant Scans. In FY99 NAE completed reports on priority pollutant scans at the two Corps flood control reservoir projects in the French River basin -- Hodges Village Dam and Buffumville Lake, and the one such project in the Blackstone River Basin – West Hill Dam. All of these projects are in Massachusetts. Sediment samples from these projects were analyzed for metals, PCBs, pesticides, volatile and semi-volatile organic compounds, dioxins and furans, and TOC. Overall, levels of EPA priority pollutants at these projects were low and indicative of natural background conditions. Although some contaminants were found in concentrations high enough to have possible effects on sensitive benthic organisms, these effects would be minor, and no substances were in high enough concentrations to pose a risk to

humans or interfere with uses of the projects and their waters. "French River Projects, Pollutant Scan," January 1999; and "West Hill Dam Pollutant Scan," April 1999 summarized these findings.

b. Naugatuck River Flow Augmentation . At the request of the Connecticut DEP, NAE agreed to make storage available at Thomaston Dam in 1999 for low flow augmentation at Thomaston Dam to alleviate water quality problems in the Naugatuck River during the upgrading of the Waterbury wastewater treatment plant (WWTP). Analysis of flows in the Naugatuck River indicated a storage of 1500 acre-feet at Thomaston Dam, in conjunction with releases from Wigwam Reservoir, could provide a reliable minimum flow of 50 cfs at the WWTP even during a repeat of the 1965 drought. If the project started storage on May 1, there was a 99 percent probability the 1500 acre-feet would be available by the beginning of June. However, to avoid canceling certain recreation activities by flooding the reservoir, Connecticut officials requested the Corps not to beginning storing water until the middle of June.

Unfortunately, the summer of 1999 turned out to be one of the driest on record with virtually no rain in June. Storage at the dam was only about 150 acre-feet, roughly a tenth of the desired volume, by the end of June when the City of Waterbury exhausted its water supply for augmentation and requested the Corps to begin releases. NAE began augmenting flows on 28 June, but there was too little storage to raise flows to the desired 120 cfs at Beacon Falls. Instead, with the agreement of all parties, Thomaston Dam released only 10 cfs above inflow, increasing flows at Beacon Falls to between 95 and 100 cfs. NAE did this to increase the amount of time augmentation flows could be made, but even at this lower rate the augmentation pool was emptied within a week.

An automatic monitor was deployed in the Thomaston Dam augmentation pool to record the effects on water quality. However, the pool was too small and maintained for too short a period to have many. There were no algal blooms or other significant changes in water quality as could have occurred with a larger pool. The monitor was retrieved after the pool was depleted in early July.

Due to the extreme low flows in the river, water quality below the Waterbury treatment plant was very poor throughout most of July and August. Low dissolved oxygen was the main problem, but odors and solids concentrations were additional concerns.

After hurricane Floyd came through in the middle of September, there was enough flow to fill the Thomaston Dam augmentation pool. However, there was enough flow in the river that augmentation from Thomaston Dam was not needed.

c. Birch Hill Dam PCB Studies. In cooperation with the Massachusetts Executive Office of Environmental Affairs (EOEA) and the USGS, NAE is participating in site characterization studies of PCB contamination at Birch Hill Dam. Data collected will be used to perform a risk assessment. In FY98 and FY99, the USGS measured PCBs in the water column using passive samplers, and a subcontractor collected additional sediment samples. Results indicate that a

section of wetlands within the Birch Hill Dam project boundaries continues to have high levels of PCBs and is a source to the water column. Additional studies are on hold pending results of US EPA and Mass. EOEA attempts to identify PRP's, a finding that would affect funding of further work.

d. Angler Surveys. In FY98 the water quality program provided funds towards a demonstration angler survey by WES. In FY99 this program continued as full surveys of four projects – West Thompson Lake in Connecticut, Hopkinton-Everett Lakes in New Hampshire, and Buffumville and East Brimfield Lakes in Massachusetts. WES subcontracted the field work to Penn State. Reports are scheduled for January 2000.

e. Cohasset Watershed Study. Concerned about potential threats to the quality of their water supply system, the town of Cohasset, Massachusetts requested NAE to perform a limited watershed study under the authority of the Planning Assistance to States Program. Sediment and water samples were collected to check for possible contamination from the former Hingham Annex, Wompatuck State Park hazardous waste site, Cohasset Heights Ltd. landfill, and residential areas draining into the Aaron River and Lily Pond. Results mostly showed levels of contamination within the expected range of background conditions even during storm runoff. In a report finished in FY99, NAE summarized findings and made recommendations for future monitoring by the town.

f. Town Brook Smelt Spawning. Due to concerns about the Town Brook local protection project's potential to affect flows in smelt-spawning areas of Town Brook, a smelt conservation team was formed in 1998. This team had members from the Corps, City of Quincy, MDC, Massachusetts Division of Marine Fisheries, and U.S. National Marine Fisheries Service. In 1999, team personnel inspected the brook before spawning began to ensure proper flows were maintained in the brook, and met regularly during the spawning season to discuss progress and issues. NAE also redesigned part of the Centre Street junction structure, a portion of the nonfederally-constructed local protection project, to improve its reliability in providing sufficient flow for spawning. This redesigned structure will be constructed in the late fall or early winter of FY00.

g. Town Brook Tunnel Water Quality. The Water Quality Certificate (WQC) issued by the Massachusetts DEP for the Town Brook tunnel requires water quality sampling and reporting of results. The 4,000 foot long, deep rock tunnel is a key part of the Town Brook Local Protection Project, and it has sophisticated water quality controls built into it. A relief tunnel, it only receives major inflows during storm events. Between storms, seawater can enter the tunnel through the outlet twice a day during high tides. The resulting mix of urban storm runoff with saltwater in an enclosed tunnel with minimal flushing (between storms) could easily lead to anaerobic conditions and the generation of hydrogen sulfide. To prevent this, the tunnel has a system of flushing pipes connected by pumps to cascade aerators at the tunnel entrance and exit. In addition, air compressors are connected to diffusers to supply additional dissolved oxygen (DO) in an emergency. Automatic water quality monitors (AWQM) measuring DO, pH, temperature, and

conductivity are connected to these pumps. Every day at a little past midnight, the pumps come on to send water to the AWQM. If the DO is above 6.0 ppm, the system shuts down; however, if it is less than that, the pumps continue to run water over the aeration cascades for an hour when another reading is taken. This reading must be at least 6.5 ppm; otherwise, pumping and aeration continue with hourly checks until 6.5 ppm is achieved. This system can be remotely accessed by computer, and data can be retrieved or the system turned on or off at any time. Each month the previous month's data are retrieved and sent to the DEP.

Monthly data from the tunnel AWQM shows generally good to excellent DO conditions. Out of the first 365 days of operation, the DO was below 6.0 on only 13 days, rarely below 5.0 and never below 4.73 ppm. Storm inflows are obvious in this monitor record because the conductivity goes down indicating saltwater is being flushed out with fresh, and the DO goes up.

In the spring of 1999, a filter on the line to the AWQM began clogging with the result that reliable DO measurements could not be obtained. Consequently, NAE began running the pumps at the inflow station continuously until a contract could be executed for recalibration and maintenance of the AWQM. Using a hand-held AWQM, WMS bleed water from the lines through valves installed for that purpose and repeatedly checked that the pumps were mixing the tunnel water and maintaining a high DO. These checks showed that the system worked very well.

After the AWQM is serviced and the automatic system is functioning reliably again in early FY00, NAE will resume sending AWQM data to the DEP until the tunnel is turned over to the MDC. However, even after the transfer occurs, NAE will use the computer connection to keep an eye on water quality conditions.

h. Parker Pond. Parker Pond in north central Massachusetts is heavily filled in with sediment and suffers from severe aquatic weed problems, especially the nonnative weed fanwort. The combination has greatly restricts habitat for aquatic animals, especially fish. Under authority in section 206 of the 1999 Water Resources Development Act, NAE is studying means to improve the pond. Initial results based on past studies and water quality and fish sampling by the Corps indicate that selective dredging to deepen the pond and remove aquatic plants and nutrient-laden sediments would improve the lake's biodiversity including the return of several fish species. A draft report was completed in FY99, and the final report is scheduled for FY00.

i. Turner Reservoir. At the request of the City of East Providence, Rhode Island, the Corps began preliminary investigations of the feasibility of using Turner Reservoir for public water supply or more intensive recreation. The water's appearance is not attractive, with large amounts of aquatic weeds and numbers of waterfowl. However, Corps investigations, including water quality and fish sampling, did not find any water quality problems that would prohibit using Turner Reservoir for recreation including swimming, or for public water supply. A draft report was completed in FY99 and the final report by the Corps is scheduled for FY00.

j. Superfund Site Studies. Water quality concerns are a major part of Superfund projects. Contaminated soil and groundwater are the most commonly encountered problems. Because of ground water mobility, water quality can be both the most important and complicated aspect of cleanups. In FY99 WMS was involved in long term monitoring studies at Baird and McGuire and cleanup of the continuing source areas at the Nyanza Chemical Company sites in Massachusetts. WMS was also involved in groundwater sampling as part of long-term monitoring of the cleanup of former military sites at Sudbury and Devens, Massachusetts, and Quonsett Point, Rhode Island.

10. Water Quality Classification.

The water quality conditions in each project have been classified in accordance with the following criteria:

(1) Class I : (a) High Water Quality, &
(b) No Known Problems

(2) Class II: Generally Good Water Quality

(3) Class III : (a) Fair Water Quality &
(b) Requires Close Monitoring of Trends and Careful Examination of Problems

Following is a list of projects evaluated according to the above classifications.

	RESERVOIRS/LAKES		
CLASSIFICATION/ DISTRICT	**I**	**II**	**III**
NAB	Alvin R. Bush Dam Raystown Lake Stillwater Lake	Almond Lake/Arkport Dam Cowanesque Lake Curwensville Lake	Aylesworth Creek Lake Dam Jenning Randolph East Foster Joseph Sayers Dam Sidney Lake Lake York Indian Rock Dam Tioga-Hammond Lakes Whitney Point Lake
NAE	Ball Mountain Lake, VT Blackwater Reservoir, NH North Springfield Lake, VT Franklin Falls Reservoir, NH Townshend Lake, VT Barre Falls Reservoir. MA Otter Brook Lake, NH Conant Brook Reservoir, MA Surry Mountain Lake, NH Hodges Village Reservoir, MA Knightville Reservoir, MA Edward MacDowell Lake, NH Black Rock Lake, CT West Hill Reservoir, MA Colebrook River Lake, CT Westville Lake, CT Hancock Brook Lake, CT Everett Lake, NH Mansfield Hollow Lake,CT Littleville Lake, MA	North Hartland Lake, VT Thomaston Reservoir, CT Hopkinton Lake, NH Buffumville Lake, MA Tully Lake, MA East Brimfield Lake, MA	Birch Hill Reservoir, MA Hop Brook Lake, CT Northfield Brook, CT Union Village Reservoir, VT West Thompson Lake, CT
NAO	NONE	Gathright Dam & Lake Moomaw	NONE
NAN	NONE	NONE	NONE
NAP	NONE	Prompton Lake F.E.Walter Reservoir	Beltzville Reservoir Blue Marsh Reservoir